Hourly runoff forecast at different lead-time for a small watershed using artificial neural networks

Abstract

Rainfall-runoff relationships are among the most complex hydrologic phenomena. The conceptual models developed by Hydrologists for simulating runoff composed of a large number of parameters and the interactions are highly complicated. The accuracy of conceptual model simulation is very subjective and highly depends on the modeler's ability and understanding of the model. Therefore, ANNs is applied to model rainfall-runoff. ANN is an information-processing system composed of many nonlinear and densely interconnected neurons. It is able to extract the relation between the inputs and outputs of a process without the physics being provided to them. Natural behavior of hydrological processes is appropriate for the application ANN in hydrology. In this paper, MLP and REC networks are adopted to forecast the hourly runoff of Sungai Bedup Basin, Sarawak. Inputs data used are antecedent rainfall, antecedent runoff and current rainfall while output is the current runoff. ANNs were trained with different training algorithms, learning rates, number of hidden neurons and antecedent hours. Results are evaluated using Coefficient of Correlation (R), Nash-Sutcliffe Coefficient (E 2) and peak error. To ensure the reliability and robustness of the optimal configuration obtained, MLP and REC networks will be further validated with six separate storm events at different lead time. Results show the performance of REC is slightly better than MLP. However, both networks are able to simulate hourly runoff with high accuracy. Therefore, both networks can be utilized as early warning flow forecaster to take necessary flood protection measures before a severe flood occurs.